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Late complications from posterior segment intraocular foreign bodies

With particular reference to retinal detachment

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During the first half of the 20th century there was a strong controversy over the route for removal of an intraocular foreign body (IOFB) lying in the posterior segment of the eye. In the early years the anterior route was substantially the method of choice (Barkan and Barkan, 1927; Verhoeff, 1932; Duggan, 1933; Trevor-Roper, 1944; and others). The posterior route had been advocated by Stieren (1932) since 1902, and gradually with control of infection and inflammation, the pendulum swung until this became substantially the method of choice (Roper-Hall, 1954; Rubinstein, 1954; and others). It is not the intention now to consider arguments of the past, but rather to consider the method of posterior route removal in the light of ensuing complications, and to discuss certain factors relating to the complication of retinal detachment.

Material

Cases were taken from a survey at the Birmingham and Midland Eye Hospital of 245 IOFBs over the decade 1961–1970, further details of which are published in the accompanying paper (Percival, 1972). Double perforations have been excluded, and when five cases in which the site of the foreign body was either in the optic nerve or never known and two cases of transfixion are also excluded, there remain 114 vitreous or preretinal foreign bodies and 39 foreign bodies clinically impacted in the retina or choroid. This group of 153 IOFBs, fifteen of which were non-magnetic, form the basis for the following study.

Route of extraction

The majority of foreign bodies were removed by the posterior route, and Table I compares the incidence of complications related to three different methods. As large foreign bodies are naturally associated with a high complication rate, all IOFBs known to be over 5 cu. mm. in size are excluded from this Table. In order that the methods should be comparable, all foreign bodies removed through the wound of entry, whether corneal or scleral, are also excluded. This tends to eliminate complications arising at the time of injury when the perforating wound was large and the ocular damage that much greater.

The anterior route method involved drawing the foreign body into the anterior chamber with a magnet and extraction through a keratome incision. The high incidence of complications and poor prognosis is striking: even retinal detachment occurred twice as frequently as after posterior route extractions.

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Table I *Complications related to method of removal (per cent.). (Entry route removals and other foreign bodies over 5 cu. mm. size excluded)*

Complication	*Route*		
	Anterior route (7)	*Pars plana* (41)	*Direct posterior* (61)
Cataract	86	54	53
Vitreous haemorrhage	43	37	39
Retinal detachment	43	20	20
Inflammation	71	17	11
Final visual acuity 6/60 or worse	71	24	21

Admittedly, in four of these cases, the anterior route had been chosen because of the existence of endophthalmitis at presentation, and three of these came to enucleation but, on looking at the other three cases, two of the extractions were associated with extensive haemorrhage and vitreous loss and the third developed severe postoperative inflammation. All three developed retinal detachment and certainly in these there did not seem to be any preoperative bias towards complications when compared with the cases which had undergone posterior route removal.

41 IOFBs were extracted through the pars plana, and 61 by a direct posterior approach. The latter involved an incision extending further than 8 mm. behind the limbus, and was used either directly over an impacted foreign body, or through that part of the globe considered to be nearest to the foreign body site.

The pars plana method has generally been the approach of choice in recent years (Shipman, Delaney, and Seely, 1953; Rubinstein, 1954; McCaslin, 1960), being thought to cause less damage to the retina. But the results given in Table I show that the complication rate and prognosis are not significantly altered by the method of posterior extraction; and, in agreement with Haik (1947), Amalong (1970) who described three cases of retinal detachment which resulted from stroking an IOFB towards the pars plana before extraction, and Cridland (1968), the direct posterior approach should certainly be the method of choice when the foreign body lies in a retinal or preretinal position.

As was suggested by Stallard (1947), traumatic perforation of the retina alone does not appear to be a significant factor in the cause of retinal detachment. But the main difficulty with the direct posterior approach is that when the IOFB is near the retina accurate localization is of prime importance in order to prevent dragging on the retina at the side of the incision. It is suggested that the Roper-Hall electro-acoustic locator is a useful adjuvant to indirect ophthalmoscopy when marking the scleral incision, and is even more important when the foreign body is not visible by ophthalmoscopy. In the present series the results with this locator were good, and compared very favourably with *x* ray methods of localization (Percival, 1972). Emphasizing the importance of accurate localization, the incidence of failed extraction at the first attempt rose to 41 per cent. when the IOFB lay in the retina or choroid, and was high even when the foreign body was seen preoperatively in the fundus (Table II).

Complications

CATARACT (other than non-progressive opacity resulting from the foreign body track)

developed in 82 of the 153 posterior segment foreign bodies (Table II). However, the visual prognosis was good, and there was no significant incidence of delayed aphakic detachment. Approximately half of the fifteen aphakic patients seen after a follow-up period of between 3 and 10 years were still wearing their contact lenses.

Table II *Complications resulting from 153 IOFBs (per cent.)*

Complications	*Clinical site*		*Foreign body visible in fundus*	*Total*	
	Vitreous	*Retina/ choroid*			
	(114)	(39)	(51)	(153) *No.*	*Per cent.*
Failed removal at first attempt	13	41	32	31	20
Lens opacity*	59	38	45	82	54
Vitreous haemorrhage	46	49	44	71	46
Vitreous and/or uveal prolapse	38	21	20	51	33
Retinal detachment	25	33	20	42	27
Inflammation	23	13	14	31	20
Siderosis	3	21	6	11	7
Macular scar†	4	10	4	9	6
Glaucoma‡	6	–	4	8	5

*excluding non-progressive opacity from foreign body tract
†unrelated to foreign body or extraction site
‡excluding that caused by swelling lens matter

MACULAR SCARRING was an occasional cause of loss of visual acuity: pigmentary changes in these patients occurred unrelated to the site of the foreign body.

GLAUCOMA, other than that caused by swelling lens matter, was rare; and of the eight cases half were associated with anterior route removals, two of these being due to secondary haemorrhage.

INFLAMMATION was present preoperatively in seventeen cases when either a hypopyon or plastic exudate was present in the anterior chamber as a result of delay in presentation. In four of these it was the reason behind the choice of anterior route removal. It led to an ultimate visual acuity of less than 6/60 in ten and to enucleation in five; it was associated with retinal detachment in five.

Inflammation developed postoperatively in fourteen cases in which either the presence of keratic precipitates had been noted or flare and cells persisted in the anterior chamber for over a month. In four of these cases the anterior route of removal had been used. Ten cases ended with a visual acuity of less than 6/60, three of which came to enucleation, and seven of which were associated with retinal detachment.

SIDEROSIS occurred in eleven patients, being associated with a delay in removal from between 2 and 12 months in four, and of over a year in the others. Three cases were associated with late retinal detachment some months after extraction of the foreign body and one with detachment at the time of presentation. The electroretinogram was studied in five of the cases: preoperatively it was severely reduced or flat in two patients who later retained 6/6 and 6/18 vision respectively; in the other three a normal electroretinogram was associated with an acuity of 6/12 or better in the postoperative period.

RETINAL DETACHMENT occurred in 42 cases. This is a high figure compared with the series reported by Roper-Hall (1954), but is partly due to the occasional referral of

complicated cases from other regions. Seven detachments were present before surgery, four of these being associated with gross disorganization requiring excision (three were due to air-gun pellets), and the other three were all associated with retention of the foreign body for more than 3 years. Another five detachments were found histologically after excision of eyes for gross disorganization or endophthalmitis.

When these groups were excluded there remained thirty instances of postoperative detachment out of a series of 134 posterior segment intraocular foreign bodies, an incidence of 22 per cent. This included ten cases in which the diagnosis was presumptive because the clinical features such as soft eye with inaccurate perception and reduced or flat electroretinogram had suggested detachment.

In contrast to Roper-Hall's series, there were no instances of transient or exudative retinal detachment.

Factors relating to retinal detachment

The incidence of factors which could be related to retinal detachment was investigated, and the Figure compares the incidence of retinal detachment with the factor present against the incidence without the factor present, compared to an overall incidence of 22 per cent.

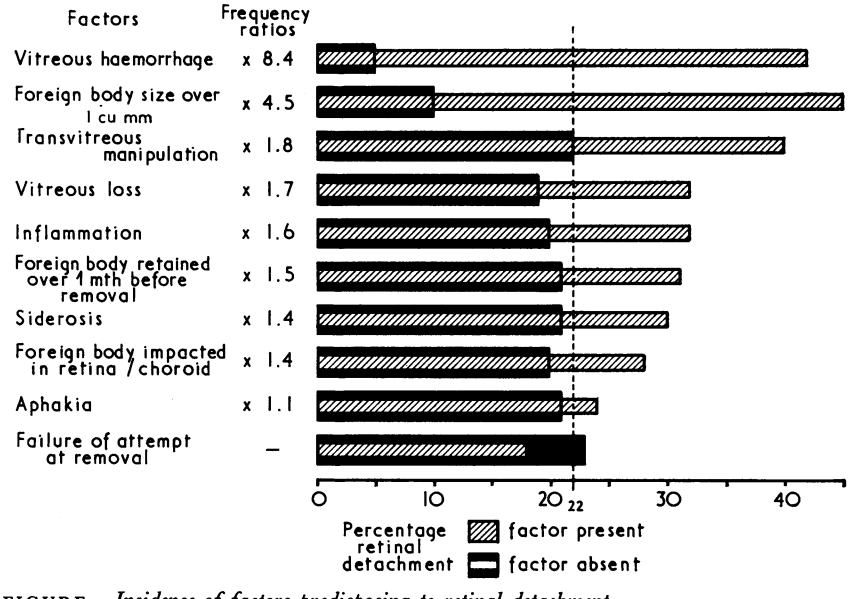

FIGURE *Incidence of factors predisposing to retinal detachment*

Analysis of 30/134 cases: overall incidence 22 per cent. (preoperative detachments and enucleated eyes excluded)

The most striking point is that retinal detachment was present in 26 of 62 patients with vitreous haemorrhage (42 per cent.), compared with only four out of 72 in patients without vitreous haemorrhage (5 per cent.)—a frequency ratio of 1 : 8·4.

Larger sizes of foreign body were also more likely to cause detachment, partly because they are also more likely to produce vitreous haemorrhage.

Intravitreous manipulation was employed in five patients and associated with detachment in two. These were both cases in which a magnetic foreign body could not be removed by the magnet because it was bound down to the retina by fibrous tissue (the others all had copper or brass particles in the vitreous removed without undue difficulty).

Inflammation and vitreous loss both led to a higher incidence of detachment. But in the 43 cases resulting in aphakia there were only ten detachments, giving a frequency ratio of only 1:1·1, and failed attempts at removal had no effect in influencing the incidence of retinal detachment, as detachment was actually more common after first-attempt removals.

Many of the factors were found to be interrelated. For instance, all the vitreous loss cases with detachment also suffered vitreous haemorrhage, or intravitreous manipulation, or endophthalmitis. However, vitreous haemorrhage as a factor differed in that when it had *not* been recorded retinal detachment as a complication was rare.

When the foreign body was impacted in the retina the incidence of detachment was only slightly higher than when the foreign body was thought to be in the vitreous (Figure); this, together with the high incidence of retinal detachment after vitreous haemorrhage, suggests that changes in the vitreous play a greater role in causing detachment than retinal breaks made by the foreign body.

In the four cases of detachment in which vitreous haemorrhage was not recorded, there had been a delay in removal of 1 week in one and of over 1 month in the other three; two patients were also noted to have siderosis.

Shortening of preretinal bands was noted specifically in sixteen of the thirty detachments, though in at least one, where there was a 10-day delay in removal, the bands were considered to be due to retinal fibrosis rather than to organization of the vitreous haemorrhage.

Management and prophylaxis of retinal detachment

Fourteen of the thirty detachments were diagnosed during the first 2 months after IOFB extraction (Table III), five were diagnosed at 4 to 5 months, four between 7 and 11 months, four between 14 and 18 months, and three at a variable and uncertain periods more than 2 years after extraction.

Table III *Delay before diagnosis of detachment*

Period between foreign body extraction and retinal detachment	*Number of cases*	*Number suitable for retinal surgery*
Under 2 wks	8	–
1–2 mths	6	2
4–5 mths	5	2
7–11 mths	4	2
14–18 mths	4	1
Over 2 yrs	3	–
Foreign body retained over 1 year with pre-operative detachment	3	2
Total	33	9

SURGERY

Seven of these detachments and two of the preoperative detachments were considered suitable for retinal surgery (Tables III and IV), and successful reposition of the retina was achieved in five. The resulting visual acuity was 6/36 or better in four, and the fifth required a second detachment procedure before satisfactory reposition was achieved.

Vitreous surgery was performed on four patients (Table IV). In one case IOFB extraction was followed by a difficult lens extraction with the capsule adherent to fibrous tissue in the vitreous, some of which was removed. Postoperatively, the visual acuity was

down to perception of light because of extensive vitreous haemorrhage, but 8 months later, when thick vitreous bands were found to be the cause of retinal tenting, these were divided and partially excised. The outcome was satisfactory, the retina being flat and the visual acuity 6/36 with an aphakic correction. The other case in which division of vitreous bands was carried out was a hopeless case of detachment and retinitis proliferans: no improvement was obtained and any idea of further surgery was later abandoned.

Table IV *Retinal and vitreous surgery*

Surgical procedure	*Number of cases*	*Resulting visual acuity*		
		Hand movements or worse	*Counting fingers to* 6/36	6/24 *or better*
Scleral indentation with cryopexy	9	4	2	3
Division of vitreous bands	2	1	1	–
Vitreous replacement	2	2	–	–

Two other patients underwent total vitrectomy and replacement with saline, but without material benefit to the eye concerned.

DIATHERMY AND CRYOPEXY

In considering methods of preventing retinal detachment, the use of surface diathermy or cryopexy over the extraction site did not alter significantly the incidence of either detachment or of vitreous haemorrhage (Table V). In this subgroup all enucleations, preoperative retinal detachments, and anterior route extractions were excluded, and so were all cases in which there was no definite evidence that vitreous haemorrhage had been caused or increased during removal of the IOFB. However, from the case records, it was often uncertain whether the diathermy had been applied before or after the removal and, as advised by Stallard (1947), it is necessary to make the application first if it is believed to have any effect on lessening vitreous haemorrhage.

Table V *Application of diathermy or cryopexy over extraction site*

Diathermy or cryotherapy	*Number of cases*	*Incidence of complications*	
		Vitreous haemorrhage	*Retinal detachment*
Application	15	27	13
No application	67	21	12

IMPLANT

When the foreign body is removed by the direct posterior approach, it is possible that a plomb implant placed over the extraction site will prevent detachment by indenting the globe at this point. But, although in most cases detachment results from the shortening of preretinal bands, these bands do not necessarily occur over the foreign body site. This procedure may therefore be reserved for those patients in which a retinal fold can be seen to be present near the extraction site at the close of the operation.

It is also possible to prevent retinal detachment during the follow-up period by careful searching for retinal breaks and retinal tenting, and in all cases complicated by vitreous haemorrhage or retinal gliosis the patient should be seen at frequent intervals. When retinal tenting is found, it is hoped that treatment, whether by local cryopexy, plomb indentation, or by division of vitreous bands, may then avert further disaster.

Conclusions

Although the pars plana route for IOFB removal should be used when the foreign body can be seen anteriorly in the vitreous, the direct posterior approach is not dangerous and does not influence significantly the incidence of complications.

Retinal detachment is common in eyes excised for disorganization or endophthalmitis, but excluding these groups the most relevant factor in the aetiology of retinal detachment is the shortening of preretinal bands. These result from organization of vitreous haemorrhage or from reaction around the foreign body and in their absence, despite the fact that the retina may have been perforated once or twice, it is considered that detachment is unlikely to occur.

In the follow-up period a careful search should be made for retinal tenting. This may occur in places other than at the site of IOFB extraction and should be treated with cryopexy alone or with cryopexy and plomb indentation depending on its extent, in order to prevent occurrence of a retinal tear. If retinal tenting is caused by bands in the vitreous which extend to the anterior segment of the eye, then these should be divided.

Summary

The nature and incidence of late complications are reported from a series of 153 posterior segment foreign bodies and the advantages of IOFB extraction by the direct posterior approach are compared with those of the pars plana route. The relatively high incidence of retinal detachment afforded an opportunity to discuss the aetiology of this complication in detail, and consideration included experiences at Birmingham over the past 10 years in the prophylaxis and management of this problem.

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